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# STAFF REPORT

Preliminary Data: Pesticide Use on Selected  
Deciduous Fruits in the United States, 1978

by

Shwu-Eng H. Webb

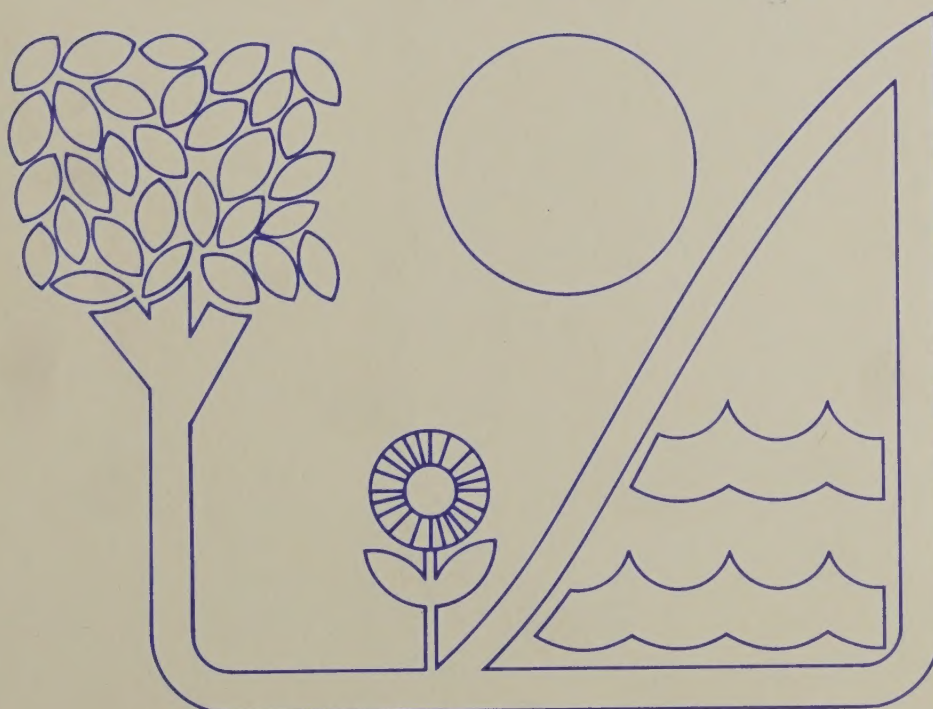
July 1981

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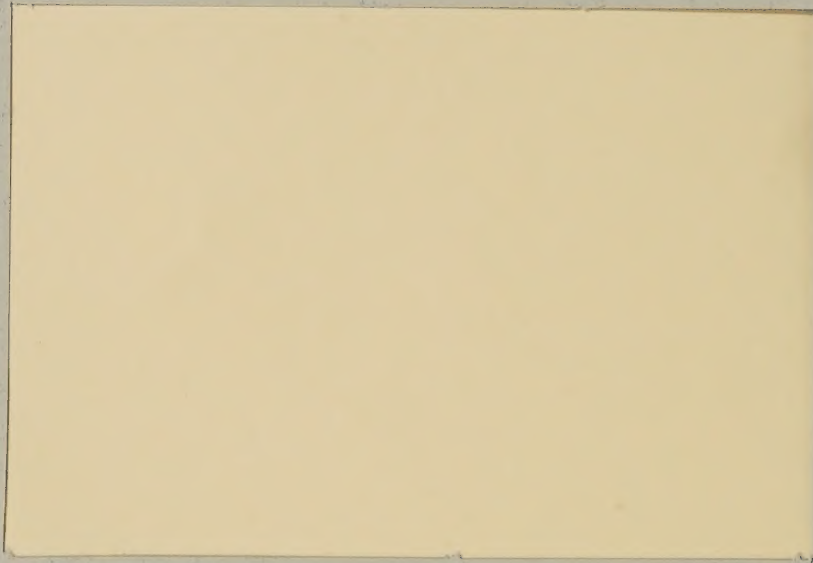
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Deciduous Fruits in the United States, 1978**

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**Shwu-Eng H. Webb**

**July 1981**

**ERS Staff Report No. AGESS810626**

**United States Department of Agriculture  
Economic Research Service  
Natural Resource Economics Division  
Washington, D. C. 20250**





Pesticide Use on Selected Deciduous Fruits in the United States, 1978. By Shwu-Eng H. Webb, Natural Resource Economics Division, Economic Research Service, U.S. Department of Agriculture, Washington, D. C. 20250; July 1981.

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### ABSTRACT

Pesticide use in the production of apples, peaches, pears, and tart cherries in 1978 is reported for four producing regions--Northeast, South, North Central, and West (excluding California). Growers of these fruits used an estimated 36.5 million pounds of pesticides in 1978--12.8 million pounds of organic pesticides, 17 million pounds of oil as an insecticide, .9 million pounds of oil as a herbicide, and 5.8 million pounds of sulfur as a fungicide. Most of the organic pesticides were fungicides and insecticides with herbicides and other pesticides used in relatively small amounts. The West was the largest user of pesticides followed by the Northeast, South, and North Central regions.

Key Words: Pesticides, organic pesticides, fungicides, insecticides, herbicides, deciduous fruits, acres treated, acre-treatments, active ingredient.

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 \* contained in this report are preliminary and are consequently \*  
 \* subject to change. The data have not been subjected to statistical \*  
 \* reliability testing, but will be tested prior to finalization and \*  
 \* publication. The data are being released at this time to allow the \*  
 \* agricultural community an opportunity to comment on the data. If \*  
 \* you have any comments, please send them to the following address by \*  
 \* September 1, 1981: Herman W. Delvo, USDA, NRED, Pest Control Branch, \*  
 \* Room 408, 500 12th Street, S.W., Washington, D. C. 20250. \*  
 \*  
 \*\*\*\*\*

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## SUMMARY

In 1978 the Economics, Statistics, and Cooperatives Service of the U.S. Department of Agriculture conducted a pesticide use survey of selected deciduous fruits: apples, peaches, pears, and tart cherries. This survey covered all the commercial producing States except California. These were grouped into four regions: (1) Northeast, (2) South, (3) West, and (4) North Central. This report presents pesticide use information on (1) quantities of active ingredients used, (2) acre-treatments, (3) acres treated, and (4) application rate per acre per season for each crop by region and the United States as a whole (excluding California).

The commercial fruit growers in the survey used about 36.5 million pounds of pesticides (including sulfur and petroleum oil) in 1978. Apples accounted for 72 percent, peaches 18 percent, pears 8 percent and tart cherries 2 percent of the pesticides applied on these crops in 1978.

Petroleum oil was used primarily as an insecticide, and to a lesser extent as a herbicide. Altogether 17.8 million pounds of oil were used on these crops in 1978. Excluding oil, fungicides were used in the greatest volume on these fruits. Growers of the surveyed fruits used about 13.1 million pounds of fungicides (including sulfur) accounting for about 36 percent of the total pesticides used. Some 4.1 million pounds of organic insecticides and 840,000 pounds of organic herbicides were applied in 1978. Other pesticides including plant growth regulators, miticides, and rodenticides accounted for the remaining 64,000 pounds used.





## INTRODUCTION

Deciduous fruits are a high value crop for which consumers have a very low tolerance for any pest damage. The use of pesticides can maintain pest populations below damaging levels resulting in the production of high quality deciduous fruits.

In 1978, the Economics, Statistics, and Cooperatives Service of the U.S. Department of Agriculture undertook a pesticide use survey of deciduous fruit growers in the United States (excluding California). The fruits surveyed were apples, peaches, pears, and tart cherries. This report presents pesticide use information for: (1) quantities of active ingredients applied, (2) acre-treatments, (3) acres treated, and (4) use per acre per season. This information is designed to aid policymakers, researchers, extension specialists and industry personnel in evaluating (1) pesticide use patterns and (2) the economic impact of regulatory actions on specific pesticides.

## METHODOLOGY

### Sample Selection

Data were collected from deciduous fruit growers during November and December 1978. About 4,500 personal interviews were conducted throughout the major producing States for each of the four deciduous fruits. The interviews provided detailed information for 1978 on quantities of specific pesticides used, acres treated, number of applications, dosage rate per acre, methods and timing of applications, and pests controlled.

In the survey, names of fruit growers to be interviewed were drawn from a list of producers maintained in the State Statistical Offices. The orchard operations were grouped according to size (either by number of trees or by acres of orchard) to increase the sampling efficiency. The sample was drawn in such a manner to insure proportional representation of all sizes of operations. Data obtained from individual operators in the survey were expanded to reflect all orchard operations by multiplying the sample data by the inverse of the sample ratio for each size group within a region. Pesticide use data were then adjusted by the ratio of the number of acres of each fruit reported grown in a region or state to the estimated acres from the survey data.

### Study Area

This survey covered all of the commercial producing states except California. The major producing states for the four fruits are grouped into the following regions: (1) Northeast, (2) South, (3) West, and (4) North Central. The regional demarcation is presented in Table 1. These regional pesticide use data were summed to obtain U.S. estimates for each of the four deciduous fruit crops surveyed.

### INTERPRETING THE DATA

Pesticide use data were collected for four stages of fruit development: pre-bloom, bloom, petal fall, and post-bloom. However, only the total amount applied per season is presented in this report. Nursery and greenhouse uses are not included. Each pesticide was placed into one of the following categories based on how it was used on deciduous fruits: (1) fungicides (used to control



Table 1. Survey area for pesticide use on deciduous fruits by region, State, and crop, 1978

Region and State	:	:	:	:	:			
	:	Apples	:	Peaches	:	Pears	:	Tart cherries
<u>Northeast</u>								
Connecticut		X		X		X		
Delaware		X		X				
Maine		X						
Maryland		X		X				
Massachusetts		X		X				
New Hampshire		X						
New Jersey		X		X				
New York		X		X		X		X
Pennsylvania		X		X		X		X
Rhode Island		X						
Vermont		X						
West Virginia		X		X				
<u>South</u>								
Alabama				X				
Arkansas		X		X				
Georgia		X		X				
Kentucky		X		X				
Louisiana				X				
Mississippi				X				
North Carolina		X		X				
Oklahoma				X				
South Carolina		X		X				
Tennessee		X		X				
Texas				X				
Virginia		X		X				
<u>West</u>								
Colorado		X		X		X		X
Idaho		X		X				
New Mexico		X						
Oregon		X		X		X		X
Utah		X		X		X		X
Washington		X		X		X		
<u>North Central</u>								
Illinois		X		X				
Indiana		X		X				
Iowa		X						
Kansas		X		X				
Michigan		X		X		X		X
Minnesota		X						
Missouri		X		X				
Ohio		X		X				
Wisconsin		X						X

diseases), (2) herbicides (used to control weeds), (3) insecticides (used to control insects), (4) miticides (used to control plant-feeding mites), (5) rodenticides (used to control rodents such as rats and mice), or (6) plant growth regulators (used to regulate fruit drop, fruit set and influence plant growth). For example, silvex in this survey was classified as a plant growth regulator, although it can be used as a herbicide.

An understanding of the terminology used in this report will help in interpreting the data. Pesticides quantities are expressed in terms of active ingredient which is the substance that controls the pest. Therefore, the quantity of any specific pesticide does not include its emulsifier, solvent, gypsum or other materials used in formulating the product.

Acres treated with a specific pesticide is the area treated with that particular pesticide one or more times. Acre-treatments are the acres treated multiplied by the number of times applied. The number of acres treated with different active ingredients in a category of pesticide products cannot be added to estimate the total land area treated because two or more active ingredients may have been used on the same acre, which would result in double counting.

## OVERALL PESTICIDE USE PATTERN

The total quantity of pesticides applied in 1978 on apples, peaches, pears, and tart cherries in the major producing states excluding California was estimated at 36.5 million pounds -- organic pesticides accounted for 12.8 million pounds; oil as an insecticide, 17 million pounds; oil as a herbicide, .9 million pounds; and sulfur as a fungicide, 5.8 million pounds (Table 2). Approximately 7.2 million pounds of the 12.8 million pounds of organic pesticides were fungicides and 4.1 million pounds were insecticides. Herbicides and other pesticides were used to a limited degree. These data suggest that disease and insect control are important issues for deciduous fruit growers.

The Northeast applied organic fungicides in the greatest volume, using about 3.4 million of the 7.2 million pounds of organic fungicides used in the U.S. For all the organic pesticides, the Northeast used about 5.2 million pounds and the other three regions applied approximately the same amount varying from 2.3 to 2.8 million pounds (Table 2).

Petroleum oil and sulfur are used in a large volume on deciduous fruits (Table 2). In 1978, about 17 million pounds of oil were used to (1) control scale insects, aphid eggs, and spider mite eggs during the dormant period and (2) protect trees against rust mites, spider mites, white flies and other insects in the June-July growing period. The West used 9.1 million pounds of oil (54 percent), followed by the Northeast with 4.5 million pounds (26 percent), and the South and North Central regions each with about 1.7 million pounds. Nearly 6 million pounds of sulfur were used as a fungicide to control a variety of plant diseases such as brown rot on peaches and scab on apples. The South accounted for 2.6 million pounds or 45 percent of the total, while the West used little sulfur, accounting for only about .4 million pounds (7 percent).



Table 2. Quantity of pesticides used on selected deciduous fruits by region, 1978 1/

Pesticide	: Northeast	: South	: West	: North	: U.S.	: Share of
	:	:	:	: Central	:	total
	----- <u>million pounds a.i.</u> -----					<u>percent</u>
Organic pesticides:						
Fungicides <u>2/</u>	3.44	1.66	.57	1.54	7.21	20
Insecticides <u>3/</u>	1.39	.75	1.34	.65	4.13	11
Herbicides <u>3/</u>	.21	.06	.51	.06	.84	2
Others <u>4/</u>	.17	.06	.36	.05	.64	2
Total	5.21	2.53	2.78	2.30	12.82	35
Sulfur as a fungicide	1.63	2.64	.42	1.15	5.84	16
Oil as an insecticide	4.45	1.68	9.14	1.69	16.96	47
Oil as a herbicide	.29	.10	.14	.34	.87	2
Grand total	11.58	6.95	12.48	5.48	36.49	100
Share of total (percent)	32	19	34	15	100	

1/ Data are from the 1978 Deciduous Fruit Survey, Natural Resource Economics Division, ESS, USDA. Crops included are apples, peaches, pears, and tart cherries. Does not include California.

2/ Excludes sulfur.

3/ Excludes oil.

4/ Includes miticides, rodenticides, and plant growth regulators.

The total commercial production of deciduous fruits included in this survey is around 9.2 billion pounds (Table 3). In terms of quantity, apples are the most important of the four fruits surveyed. Commercial apple production, excluding California, in 1978 was about 7.1 billion pounds. Commercial peach production in 1978 was 1.0 billion pounds, pear production .9 billion pounds, and tart cherry production .2 billion pounds. Of the 12.8 million pounds of organic pesticides used on these fruits, apples accounted for 10.1 million pounds (79 percent), followed by peaches at 1.7 million pounds (13 percent), pears at .7 million pounds (5 percent), and tart cherries at .4 million pounds (3 percent).

Pesticide use (excluding sulfur and oil) per 1,000 pounds of fruit production ranged from 0.8 pounds (a.i.) for pears to 2.0 pounds (a.i.) for tart cherries. With the inclusion of sulfur and oil, the average pesticide use ranged from 3.1 pounds (a.i.) per 1,000 pounds for pears to 6.0 pounds (a.i.) for peaches.

The West and Northeast are the main apple producing areas (Table 4). The South is the main peach area, the West the main pear area, and the North Central the main tart cherry area.

Examination of the percentage figures in Table 4 reveals that the production of each deciduous fruit and pesticide use by region tends to be in the same proportion. An exception is in the West where pesticides are used more intensively on tart cherries accounting for 19 percent of the pesticides but only 9 percent of the production.

#### CATEGORIES OF PESTICIDES USED BY CROP

The quantity of pesticides used and acre-treatments for each deciduous fruit crop by region are discussed in this section. Pesticides included are: organic fungicides, insecticides, and herbicides; sulfur as a fungicide; and oil as an insecticide or herbicide.

Table 3. Commercial production and pesticides used on selected deciduous fruits, 1978

Crop	:	:	Pesticide		Pesticide use per 1,000	
	:	Commercial	:	use 2/	:	pounds of fruit
	:	production	:	:	:	:
	:	1/	:	Total : Organic	:	Total : Organic
	:		:	3/ :	:	3/ :
	million	1,000				
	<u>pounds</u>	<u>pounds a.i.</u>		<u>pounds a.i.</u>		
Apples	7,107	26,428	10,109	3.72	1.42	
Peaches	1,072	6,457	1,667	6.02	1.56	
Pears	878	2,753	678	3.14	.77	
Tart cherries	181	832	358	4.60	1.98	
Total	9,238	36,470	12,812	3.95	1.39	

1/ Data compiled from Noncitrus Fruits and Nuts, U.S. Department of Agriculture, Statistical Reporting Service, FrNt 1-3(80), January 1980.

2/ Data are from the 1978 Deciduous Fruit Survey, Natural Resource Economics Division, ESS, USDA. Does not include California.

3/ Includes sulfur and oil.



Table 4. Distribution of selected commercial deciduous fruit production and pesticide use by region, 1978

Item	Northeast	South	West <u>1/</u>	North Central	U.S.
<hr/>					
	<hr/> million pounds <hr/>				
<u>Crop 2/</u>					
Apples	2,309	919	2,513	1,366	7,107
Peaches	232	651	84	105	1,072
Pears	48	--	804	26	878
Tart cherries	25	--	16	140	181
Total	2,614	1,570	3,417	1,637	9,238
	<hr/> percent <hr/>				
<u>Regional share</u> <u>by crop</u>					
Apples	33	13	35	19	100
Peaches	21	61	8	10	100
Pears	5	--	92	3	100
Tart cherries	14	--	9	77	100
Total	28	17	37	18	100
	<hr/> percent <hr/>				
<u>Regional share of</u> <u>pesticide use 3/</u>					
Apples	36	12	36	16	100
Peaches	26	57	6	11	100
Pears	10	--	88	2	100
Tart cherries	16	--	19	65	100
Total	32	19	34	15	100

— none reported.

1/ Does not include California.

2/ Data compiled from Noncitrus Fruits and Nuts, U.S. Department of Agriculture, Statistical Reporting Service, FrNt 1-3(80), January 1980.

3/ Based on data from the 1978 Deciduous Fruit Survey, National Resource Economics Division, ESS, USDA. Does not include California.

### Apples

Apple growers reported the use of 26.4 million pounds of pesticides in 1978 -- organic pesticides accounted for 10.1 million pounds; oil 14.9 million pounds of which 14.3 million pounds were used as an insecticide and .6 million pounds used as a herbicide; and sulfur 1.4 million pounds (Table 5).

The West is the largest user of oil. It accounted for 7.1 million (50 percent) of the 14.3 million pounds of oil used on apples. The Northeast was the second most important using 4.2 million pounds or 29 percent of the total. Considering all pesticides, the Northeast and West regions used about the same amount, 9.5 million pounds, followed by the North Central and South with about 4.2 million and 3.3 million pounds, respectively. Of the 10.1 million pounds of organic pesticides used on apples, 4.5 million pounds (45 percent) were used in the Northeast, followed by the West at 2.1 million pounds (21 percent), with the North Central and South regions using 1.8 million pounds (18 percent) and 1.6 million pounds (16 percent), respectively. The Northeast used organic fungicides in the greatest volume accounting for 3.1 million of the 5.9 million pounds used on apples.

The total acre-treatments of pesticides on apples were about 8.6 million, of which 4.3 million were in the Northeast (Table 6). Acre-treatments in the other three regions were approximately equal ranging from 1.3 to 1.6 million acre-treatments. About 93 percent of the acre-treatments were with organic pesticides with half (about 4.0 million) in the Northeast and the other half distributed about equally between the other three regions. Because oils are applied at a much higher rate than organic pesticides, the 14.3 million pounds

Table 5. Apples: Quantity of pesticides applied by region, 1978 1/

Pesticides	:	:	:	:	:	:				
	:	Northeast	:	South	:	West	:	North	:	U.S.
	:	:	:	:	:	:	:	Central	:	:
----- <u>1,000 pounds a.i.</u> -----										
Organic pesticides:										
Fungicides <u>1/</u>	3,067	1,207	281	1,329	5,884					
Insecticides <u>2/</u>	1,128	329	1,062	445	2,964					
Herbicides <u>2/</u>	180	22	475	29	706					
Others <u>3/</u>	159	44	307	45	555					
Total	4,534	1,602	2,125	1,848	10,109					
Sulfur as a fungicide	660	121	236	436	1,453					
Oil as an insecticide	4,170	1,444	7,072	1,569	14,255					
Oil as a herbicide	144	84	61	322	611					
Grand total	9,508	3,251	9,494	4,175	26,428					

1/ Excludes sulfur.

2/ Excludes oil.

3/ Includes miticides, rodenticides, and plant growth regulators.

Prepared by Webb, Shwu-Eng from the 1978 Deciduous Fruit Survey, Natural Resource Economics Division, ESS, USDA, unpublished.



Table 6. Apples: Acre-treatments with pesticides by region, 1978 1/

	:	:	:	:	:	:	: Share
Pesticides	: Northeast	: South	: West	: North	: U.S.	: of	
	:	:	:	: Central	:	: total	
<hr/>							
	----- <u>1,000 acre-treatments</u> -----					<u>percent</u>	
Organic pesticides:							
Fungicides <u>2/</u>	2,161	730	110	829	3,830	44	
Insecticides <u>3/</u>	1,423	437	668	510	3,038	35	
Herbicides <u>3/</u>	80	18	179	23	300	5	
Others <u>4/</u>	334	72	302	91	799	9	
Total	3,998	1,257	1,259	1,453	7,967	93	
Sulfur as a fungicide	175	28	20	60	283	3	
Oil as an insecticide	124	38	125	50	337	4	
Oil as a herbicide	10	2	2	13	27	<u>5/</u>	
Grand total	4,307	1,325	1,406	1,576	8,614	100	
Share of total (percent)	50	15	16	18	100		

1/ Data are from the 1978 Deciduous Fruit Survey, Natural Resource Economics Division, ESS, USDA. Does not include California.

2/ Excludes sulfur.

3/ Excludes oil.

4/ Includes miticides, rodenticides, and plant growth regulators.

5/ Less than .5 percent.

of oil used as an insecticide were applied in only 337,000 acre-treatments, whereas the 10.1 million pounds of organic pesticides were used in about 8.0 million acre-treatments.

### Peaches

About 6.5 million pounds of pesticides were used on peaches in 1978 -- organic pesticides accounted for 1.7 million pounds; sulfur as a fungicide, 3.9 million pounds; oil .9 million pounds, of which 736,000 pounds were used as an insecticide and 123,000 pounds as a herbicide (Table 7).

As the main peach producing area, the South accounted for about 3.7 million (57 percent) of the 6.5 million pounds of pesticides used on peaches. The Northeast was the second most important using 1.7 million pounds, followed by North Central at .7 million pounds and the West at .4 million pounds. As for sulfur, about 2.5 million (64 percent) of 3.9 million pounds were used in the South, followed by the Northeast with .9 million pounds, the North Central at .5 million pounds, and the West with only a very small amount, 35,000 pounds. Of the 1.7 million pounds of organic pesticides used on peaches, the South again was the most important accounting for .9 million pounds, followed by the Northeast at .5 million pounds, the North Central and the West regions with the remaining .3 million pounds.

The total acre-treatments with all pesticides were about 2.4 million of which 1.3 million were in the South (Table 8). About 75 percent (or 1.7 million) of the total acre-treatments were with organic pesticides, primarily with fungicides and insecticides, of which 1.0 million were in the South followed by the Northeast at .5 million. Because sulfur is applied at a much higher rate than organic pesticides, the 3.9 million pounds of sulfur were used in only

Table 7. Peaches: Quantity of pesticides applied by region, 1978 1/

Pesticides	: : Northeast :	: : South :	: : West :	: : North : Central :	: : U.S. :	: Share : of : total
	----- <u>1,000 pounds a.i.</u> -----					<u>percent</u>
Organic pesticides:						
Fungicides <u>2/</u>	265	455	43	76	839	13
Insecticides <u>3/</u>	192	423	33	90	738	11
Herbicides <u>3/</u>	29	39	2	6	76	1
Others <u>4/</u>	2	10	1	1	14	<u>5/</u>
Total	488	927	79	173	1,667	26
Sulfur as a fungicide	919	2,518	35	459	3,931	61
Oil as an insecticide	182	234	256	64	736	11
Oil as a herbicide	80	13	14	16	123	2
Grand total	1,669	3,692	384	712	6,457	100
Share of total (percent)	26	57	6	11	100	

1/ Data are from the 1978 Deciduous Fruit Survey, Natural Resource Economics Division, ESS, USDA. Does not include California.

2/ Excludes sulfur.

3/ Excludes oil.

4/ Includes miticides, rodenticides, and plant growth regulators.

5/ Less than .5 percent.



Table 8. Peaches: Acre-treatments with pesticides by region, 1978 1/

Pesticides	:	:	:	:	:	:	:	Share				
	:	Northeast	:	South	:	West	:	North	:	U.S.	:	of
	:		:		:		:	Central	:		:	total

1/ Data are from the 1978 Deciduous Fruit Survey, Natural Resource Economics Division, ESS, USDA. Does not include California.

2/ Excludes sulfur.

3/ Excludes oil.

4/ Includes miticides, rodenticides, and plant growth regulators.

5/ Less than .5 percent.

.6 million acre-treatments, whereas the 1.7 million pounds of organic pesticides were used in 1.7 million acre-treatments.

### Pears

Pear growers reported the use of about 2.8 million pounds of pesticides in 1978. Organic pesticides accounted for .7 million pounds, oil 2.0 million pounds, and sulfur .1 million pounds (Table 9).

As the main pear producing area, the West accounted for 2.4 million pounds (86 percent) of the 2.8 million pounds of the pesticides used on pears. The Northeast used about .3 million pounds and the North Central used only about 49,000 pounds of pesticides on pears. The West used about 1.7 million pounds (89 percent) of the 1.9 million pounds of oil used as an insecticide, followed by the Northeast at 137,000 pounds, and the North Central with 26,000 pounds. For the organic pesticides, about 546,000 pounds (81 percent) of the total 678,000 pounds used were in the West, followed by the Northeast with 111,000 pounds and the North Central at 21,000 pounds.

The total acre-treatments of pesticides on pears were about 482,000, of which 385,000 (80 percent) were in the West (Table 10). About 89 percent (430,000) of the total acre-treatments were with organic pesticides of which 339,000 were in the West, followed by the Northeast with 81,000 and the North Central with only about 10,000. Since oil was applied at a higher rate (45 pounds) per treatment than the organic pesticides (1.6 pounds), the 1.9 million pounds of oil used as an insecticide were applied in about 42,000 acre-treatments, whereas the .7 million pounds of organic pesticides were used in about 430,000 acre-treatments.

Table 9. Pears: Quantity of pesticides applied by region, 1978 1/

Pesticides	:	:	:	:	:	:	:	Share				
	:	Northeast	:	South	:	West	:	North	:	U.S.	:	of
	:		:		:		:	Central	:		:	total
----- <u>1,000 pounds a.i.</u> ----- <u>percent</u>												
Organic pesticides:												
Fungicides <u>2/</u>	53	--		235	13			301		11		
Insecticides <u>3/</u>	52	--		227	8			287		10		
Herbicides <u>3/</u>	4	--		31	<u>5/</u>			35		1		
Others <u>4/</u>	2	--		53	<u>5/</u>			55		2		
Total	111	--		546	21			678		24		
Sulfur as a fungicide	<u>5/</u>	--		100	1			101		4		
Oil as an insecticide	137	--		1,728	26			1,891		69		
Oil as a herbicide	22	--		60	1			83		3		
Grand total	270	--		2,434	49			2,753		100		
Share of total (percent)	10	--		88	2			100				

-- none reported.

1/ Data are from the 1978 Deciduous Fruit Survey, Natural Resource Economics Division, ESS, USDA. Does not include California.

2/ Excludes sulfur.

3/ Excludes oil.

4/ Includes miticides, rodenticides, and plant growth regulators.

5/ Less than 500 pounds.



Table 10. Pears: Acre-treatments with pesticides by region, 1978 1/

Pesticides	:	:	:	:	:	:	: Share
	:	Northeast	: South	: West	: North	: U.S.	: of
	:	:	:	:	: Central	:	: total
----- <u>1,000 acre-treatments</u> ----- <u>percent</u>							
Organic pesticides:							
Fungicides <u>2/</u>	34	--	91	4	129	27	
Insecticides <u>3/</u>	40	--	155	6	201	42	
Herbicides <u>3/</u>	2	--	15	<u>5/</u>	16	3	
Others <u>4/</u>	5	--	78	<u>5/</u>	84	17	
Total	81	--	339	10	430	89	
Sulfur as a fungicide	<u>5/</u>	--	7	<u>5/</u>	7	1	
Oil as an insecticide	4	--	37	1	42	9	
Oil as a herbicide	1	--	2	<u>5/</u>	3	1	
Grand total	86	--	385	11	482	100	
Share of total (percent)	18	--	80	2	100		

-- none reported.

1/ Data are from the 1978 Deciduous Fruit Survey, Natural Resource Economics Division, ESS, USDA. Does not include California.

2/ Excludes sulfur.

3/ Excludes oil.

4/ Includes miticides, rodenticides, and plant growth regulators.

5/ Less than 500 acres.

### Tart Cherries

Tart cherry growers reported the use of about 832,000 pounds of pesticides in 1978--organic pesticides accounted for 358,000 pounds; sulfurs as a fungicide, 350,000 pounds; oil as an insecticide, 123,000 pounds. Very small amounts of oil were used as a herbicide (Table 11).

The main tart cherry producing area, the North Central region, accounted for about 540,000 (65 percent) of the 832,000 pounds of pesticides used on tart cherries. The West and Northeast regions applied about the same amount accounting for 160,000 and 131,000 pounds, respectively. Of the 358,000 pounds of organic pesticides used on tart cherries, the North Central accounted for 257,000 pounds (72 percent), followed by the Northeast at 79,000 pounds and the West with only 22,000 pounds. As for sulfur, about 248,000 pounds (71 percent) were used in the North Central, with the Northeast and West regions each using about 50,000 pounds.

The total acre-treatments of pesticides on tart cherries were about 345,000 of which 247,000 were in the North Central region, followed by the Northeast at 76,000 and the West at 22,000 (Table 12). About 299,000 (87 percent) of the total 345,000 acre-treatments were with organic pesticides, of which 216,000 were in the North Central, followed by the Northeast at 68,000 and the West at 15,000. Since sulfur was applied at a higher rate per acre-treatment (8.2 pounds) than organic pesticides (1.2 pounds), the 350,000 pounds of sulfur were applied in 43,000 acre-treatments, whereas the 358,000 pounds of organic pesticides were applied in 299,000 acre-treatments.

Table 11. Tart cherries: Quantity of pesticides applied by region, 1978 1/

Pesticides	Northeast	South	West	North Central	U.S.	Share of total
<hr/>						
	----- 1,000 pounds a.i. -----					percent
Organic pesticides:						
Fungicides <u>2/</u>	53	--	8	123	184	22
Insecticides <u>3/</u>	21	--	13	102	136	16
Herbicides <u>3/</u>	2	--	1	28	31	4
Others <u>4/</u>	3	--	<u>5/</u>	4	7	1
Total	79	--	22	257	358	43
Sulfur as a fungicide	50	--	52	248	350	42
Oil as an insecticide	2	--	86	35	123	15
Oil as a herbicide	<u>5/</u>	--	1	--	1	<u>6/</u>
Grand total	131	--	161	540	832	100
Share of total (percent)	16	--	19	65	100	

-- none reported.

1/ Data are from the 1978 Deciduous Fruit Survey, Natural Resource Economics Division, ESS, USDA. Does not include California.

2/ Excludes sulfur.

3/ Excludes oil.

4/ Includes miticides, rodenticides, and plant growth regulators.

5/ Less than 500 pounds.

6/ Less than .5 percent



Table 12. Tart cherries: Acre-treatments with pesticides by region, 1978 1/

Pesticides	:	:	:	:	:	:	:	Share				
	:	Northeast	:	South	:	West	:	North	:	U.S.	:	of
	:		:		:		:	Central	:		:	total
		<u>1,000 acre-treatments</u>										<u>percent</u>
Organic pesticides:												
Fungicides <u>2/</u>	40	--		5		114		159		46		
Insecticides <u>3/</u>	23	--		9		91		123		36		
Herbicides <u>3/</u>	1	--		1		9		11		3		
Others <u>4/</u>	4	--		<u>5/</u>		2		6		2		
Total	68	--		15		216		299		87		
Sulfur as a fungicide	8	--		5		30		43		12		
Oil as an insecticide	<u>5/</u>	--		2		1		3		1		
Oil as a herbicide	<u>5/</u>	--		<u>5/</u>		--		<u>5/</u>		<u>6/</u>		
Grand total	76	--		22		247		345		100		
Share of total (percent)	22	--		6		72		100				

-- none reported.

1/ Data are from the 1978 Deciduous Fruit Survey, Natural Resource Economics Division, ESS, USDA. Does not include California.

2/ Excludes sulfur.

3/ Excludes oil.

4/ Includes miticides, rodenticides, and plant growth regulators.

5/ Less than 500 acres.

6/ Less than .5 percent.

## SELECTED PESTICIDES USED BY CATEGORY

The quantity of specific pesticide materials applied on each of the four deciduous fruits, the number of acres treated, and the use per acre per season are summarized in this section.

### Insecticides

Growers of the four deciduous fruits used about 21.1 million pounds of insecticides in 1978 -- 17.2 million pounds were applied to apples, 1.5 million pounds to peaches, 2.2 million pounds to pears, and 258,000 pounds to tart cherries (Table 13). Of the 21.1 million pounds of insecticides, petroleum oil accounted for 17.0 million pounds with apples accounting for 14.3 million pounds with pears second (1.9 million pounds), followed by peaches (.7 million pounds), and tart cherries (.1 million pounds).

The major organic insecticides used by deciduous fruit growers in 1978 were azinphos-methyl, phosmet, and parathion. Azinphos-methyl and phosmet were used primarily on apples while parathion was used primarily on peaches.

Based on quantity, the most important organic insecticide used on apples was azinphos-methyl, accounting for 29 percent of the total. Parathion was the most important organic insecticide applied on peaches and tart cherries. Five different insecticides were of roughly equal importance to pear growers, each accounting for 13 to 17 percent of the organic insecticides applied.

Oil was used rather extensively in apple and pear orchards with about 57 percent and 55 percent of the apple and pear acreages, respectively, receiving oil treatments. Azinphos-methyl was the most commonly used insecticide for apples, being used on 70 percent of the apple acreage. About 52 percent of the

Table 13. Insecticides: Quantity applied, acres treated, rate per acre per season for leading insecticides on selected deciduous fruits for the United States, excluding California, 1978 1/ - continued

Crop and insecticide	Quantity applied		Acres treated		Use per acre
	1,000 pounds a.i.	percent	1,000 acres	percent treated 2/	pounds a.i. per season
<u>Apples</u>					
Azinphos-methyl	860.3	29.0	335.5	69.8	2.56
Phosmet	569.4	19.2	129.6	27.0	4.39
Parathion	243.8	8.2	142.0	29.6	1.72
Carbaryl	209.2	7.1	102.3	21.3	2.05
Endosulfan	176.1	5.9	88.8	18.5	1.98
Diazinon	147.1	5.0	50.5	10.5	2.91
Phosphamidon	136.4	4.6	75.6	15.7	1.80
Phosalone	132.9	4.5	54.0	11.2	2.46
Demeton	123.6	4.2	79.7	16.6	1.55
Others	364.8	12.3	<u>3/</u>	--	--
Total organic	2,963.6	100.0	<u>3/</u>	--	--
Oil	14,255.2	--	271.8	56.6	52.45
Total	17,218.8	--	<u>3/</u>	--	--
<u>Peaches</u>					
Parathion	270.0	36.6	80.3	52.3	3.36
Endosulfan	141.7	19.2	32.8	21.4	4.32
Phosmet	89.3	12.1	27.0	17.6	5.07
Azinphos-methyl	81.1	11.0	41.8	27.2	1.94
Carbaryl	73.5	10.0	27.0	17.6	2.72
Chlorpyrifos	51.0	6.9	12.9	8.4	3.95
Others	31.0	4.2	<u>3/</u>	--	--
Total organic	737.6	100.0	<u>3/</u>	--	--
Oil	736.2	--	23.4	15.2	31.46
Total	1,473.8	--	<u>3/</u>	--	--

- continued -



Table 13. Insecticides: Quantity applied, acres treated, rate per acre per season for leading insecticides on selected deciduous fruits for the United States, excluding California, 1978 1/ - continued

Crop and insecticide	Quantity applied 1,000 pounds a.i.	percent	Acres treated 1,000 acres	Use per acre percent treated 2/ pounds a.i.
<u>Pears</u>				
Amitraz	48.6	16.9	24.0	44.5
Phosmet	46.8	16.3	13.0	24.1
Ethylan	44.0	15.3	10.9	20.2
Endosulfan	41.5	14.4	14.1	26.1
Azinphos-methyl	36.6	12.7	23.2	43.0
Phosalone	20.8	7.2	3.8	7.1
Ethion	13.0	4.5	3.7	6.9
Parathion	12.3	4.3	11.4	21.1
Others	23.9	8.3	3/	--
Total organic	287.5	100.0	3/	--
Oil	1,890.3	--	29.6	54.9
Total	2,177.8	--	3/	--
<u>Tart cherries</u>				
Parathion	50.6	37.4	10.3	17.3
Azinphos-methyl	39.2	28.9	21.4	35.9
Carbaryl	19.2	14.2	6.1	10.2
Phosmet	8.8	6.5	6.0	10.1
Diazinon	6.8	5.0	1.1	1.9
Phosalone	3.5	2.6	.8	1.3
Others	7.3	5.4	3/	--
Total organic	135.4	100.0	3/	--
Oil	122.6	--	2.6	4.4
Total	258.0	--	3/	--
<u>All Fruits</u>				
Organic	4,124.1	--	--	--
Oil	17,004.3	--	--	--
Total	21,128.4	--	--	--

-- not applicable.

1/ Data are from the 1978 Deciduous Fruit Survey, Natural Resource Economics Division, ESS, USDA. Does not include California.

2/ The percent of acres treated with specific insecticides was calculated using acres grown for each crop as reported in the 1974 Census of Agriculture.

3/ Data not reported because two or more insecticides may have been used on the same acreage which would result in double counting.

peach acreage received parathion treatment and 45 percent of the pear acreage was treated with amitraz.

The amount of an insecticide applied per acre per season varied among specific pesticides. Oil was applied at a heavy rate per acre ranging from 31 pounds on peaches to 64 pounds on pears. The application rate of organic insecticides per acre ranged from 1.6 pounds for demeton to 4.4 pounds for phosmet on apples, from 1.9 pounds for azinphos-methyl to 5.1 pounds for phosmet on peaches, from 1.1 pounds for parathion to 5.5 pounds for phosalone on pears, and from 1.5 pounds for phosmet to 6.2 pounds for diazinon on tart cherries.

### Fungicides

Deciduous fruit growers reported the use of about 13.0 million pounds of fungicides in 1978--7.3 million pounds were applied to apples, 4.8 million pounds to peaches, .4 million pounds to pears, and .5 million pounds on tart cherries (Table 14). Of the 13.0 million pounds of fungicides used, organic fungicides accounted for 7.4 million pounds and sulfur accounted for 5.6 million pounds. Sulfur was used primarily on peaches (3.6 million pounds), followed by apples (1.2 million pounds), and tart cherries (345,000 pounds).

Based on quantity, captan was the most important fungicide used on apples accounting for 23 percent of the total. Maneb, sulfur, and metiram were of roughly equal importance to apple growers with each accounting for 16 to 18 percent of the total fungicides applied. Sulfur was, by far, the most important fungicide, accounting for 76 percent of all the fungicides used on peaches. Captan and calcium polysulfide were two other important fungicides used on peaches accounting for 10 and 6 percent, respectively. Zineb and sodium polysulfide were the two most important fungicides used on pears, accounting for 20

Table 14. Fungicides: Quantity applied, acres treated, rate per acre per season for leading fungicides on selected deciduous fruits for the United States, excluding California, 1978 1/

Crop and fungicide	:	:	:	:	:
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Table 14. Fungicides: Quantity applied, acres treated, rate per acre per season for leading fungicides on selected deciduous fruits for the United States, excluding California, 1978 1/ - continued

Crop and fungicide	:	:	:	:	Use per acre per season
	:	:	:	:	
	:	Quantity applied	:	Acres treated	:
	:		:		:
	:		:		:
	1,000 pounds		1,000	percent	
	<u>a.i.</u>	<u>percent</u>	<u>acres</u>	<u>treated</u>	<u>pounds</u>
				<u>2/</u>	<u>a.i.</u>
Ziram	32.6	8.1	3.3	6.1	9.88
Copper hydroxide	32.0	8.0	2.0	3.7	10.00
Calcium polysulfide	31.9	7.9	1.0	1.9	31.90
Captan	23.4	5.8	2.8	5.2	8.36
Dodine	19.4	4.8	8.7	16.1	2.23
Sulfur	16.4	4.1	1.0	1.9	16.40
Maneb	15.6	3.9	1.8	3.3	8.67
Copper sulfate	15.3	3.8	4.2	7.8	3.64
Streptomycin	14.3	3.6	18.9	35.0	.76
Others	30.6	7.5	<u>3/</u>	--	--
Total	402.7	100.0	<u>3/</u>	--	--
Tart cherries					
Sulfur	344.6	64.4	13.7	23.0	25.15
Difolatan	69.7	13.0	12.3	20.7	5.67
Captan	53.4	10.0	11.1	18.6	4.81
Dodine	18.1	3.4	10.3	17.3	1.76
Benomyl	12.8	2.4	14.1	23.7	.91
Ferbam	12.8	2.4	2.3	3.9	5.57
Others	23.6	4.4	<u>3/</u>	--	--
Total	535.0	100.0	<u>3/</u>	--	--
All fruits					
Organic	7,419.2	--	--	--	--
Sulfur	5,593.5	--	--	--	--
Other inorganic	32.0	--	--	--	--
Total	13,004.7	--	--	--	--

-- not applicable

1/ Data are from the 1978 Deciduous Fruit Survey, Natural Resource Economics Division, ESS, USDA. Does not include California.

2/ The percent of acres treated with specific fungicides was calculated using acres grown for each crop as reported in the 1974 Census of Agriculture.

3/ Data not reported because two or more fungicides may have been used on the same acreage which would result in double counting.

and 13 percent of the 403,000 pounds of fungicides used on pears. The most important fungicide used on tart cherries was sulfur, accounting for 64 percent of the 535,000 pounds of fungicides used. Difolatan and captan accounted for 13 and 10 percent of the total fungicides applied on tart cherries.

Captan was the most commonly used fungicide for apples based on acres treated. About 35 percent of the apple acreage was treated with captan. Sulfur was important for peaches and tart cherries with about 55 percent and 23 percent of the acreage treated. Benomyl and captan were also commonly used in peach orchards, with about 52 and 40 percent of the acreage treated. Streptomycin was the most commonly used fungicide for pears with 35 percent of the acreage treated.

The application rate of the leading fungicides per acre per season ranged from .9 pounds for benomyl to 17.3 pounds for calcium polysulfide on apples, from 1.1 pounds for benomyl to 42.7 pounds for sulfur on peaches, from .8 pounds for streptomycin to 31.9 pounds for calcium polysulfide on pears, and from .9 pounds for benomyl to 25.2 pounds for sulfur on tart cherries.

### Herbicides

Deciduous fruit growers used smaller amounts of herbicides than either insecticides or fungicides. Growers of the four deciduous fruits used about 1.7 million pounds of herbicides in 1978—1.3 million pounds were applied to apples, 198,000 pounds to peaches, 118,000 pounds to pears, and 31,500 pounds to tart cherries (Table 15). Of the 1.7 million pounds of herbicides, petroleum oil accounted for .8 million pounds, of which 75 percent (.6 million pounds) was applied to apples.

Table 15. Herbicides: Quantity applied, acres treated, rate per acre per season for leading materials on selected deciduous fruits for the United States, excluding California, 1978 1/

Crop and herbicide	Quantity applied	Acres treated	Use per acre per season		
	1,000 pounds a.i.	percent	1,000 acres	percent treated 2/	pounds a.i.
Apples					
DNBP	127.0	18.0	26.0	5.4	4.88
DNOC	121.1	17.2	15.2	3.2	7.97
Paraquat	103.0	14.6	76.8	16.0	1.34
Simazine	102.1	14.5	42.1	8.8	2.43
Ammate	93.5	13.2	7.4	1.5	12.64
Sinbar	56.8	8.0	39.1	8.1	1.45
Dichlobenil	43.6	6.2	8.8	1.8	4.95
Diuron	28.9	4.1	13.1	2.7	2.21
2,4-D	20.3	2.9	17.8	3.7	1.14
Others	9.5	1.3	3/	3/	--
Total Organic	705.8	100.0	3/	--	--
Oil	611.4	--	11.7	2.4	52.26
Total	1,317.2	--	3/	--	--
Peaches					
Paraquat	25.4	33.5	23.9	15.6	1.06
Simazine	24.3	32.0	11.8	7.7	2.06
Diuron	13.4	17.7	8.3	5.4	1.61
Sinbar	10.0	13.2	8.5	5.5	1.18
Others	2.7	3.6	3/	--	--
Total Organic	75.8	100.0	3/	--	--
Oils	122.6	--	3.9	2.5	31.44
Total	198.4	--	3/	--	--

- continued -



Table 15. Herbicides: Quantity applied, acres treated, rate per acre per season for leading materials on selected deciduous fruits for the United States, excluding California, 1978 1/

Crop and herbicide	:	:	:	:	:
	:	:	:	:	:
	:	Quantity applied	:	Acres treated	:
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-- Not applicable.

1/ Data are from the 1978 Deciduous Fruit Survey, Natural Resource Economics Division, ESS, USDA. Does not include California.

2/ The percent of acres treated with specific herbicides was calculated using acres grown for each crop as reported in the 1974 Census of Agriculture.

3/ Data not reported because two or more herbicides may have been used on the same acreage which would result in double counting.

The major organic herbicides used by deciduous fruit growers were paraquat, DNOC, and DNBP. DNBP was used almost exclusively on apples. Paraquat was used on apples, peaches, and tart cherries while DNOC was used primarily on apples and pears.

Five different herbicides--DNBP, DNOC, paraquat, simazine, and ammate--were of roughly equal importance to apple growers with each accounting for 13 to 18 percent of the organic herbicides applied. Paraquat and simazine were the most important herbicides used on peaches accounting for 34 and 32 percent, respectively. DNOC was the most important organic herbicide used on pears accounting for 36 percent of organic herbicides used. Paraquat dominated the use of herbicides on tart cherries, accounting for 85 percent of the total.

In general, paraquat was the most commonly used herbicides for these fruits based on acres treated. About 16 percent of the apple and peach acreage, 9 percent of the pear acreage, and 10 percent of the tart cherry acreage received paraquat treatments.

The amount of a herbicide applied per acre per season varied widely among specific materials. Oil was used very heavily on apples, peaches, and pears with rates per acre ranging from 31 pounds on peaches to 52 pounds on apples. On cherries, the rate was only 3 pounds per acre. The application rate per acre for organic herbicides ranged from 1.1 pounds for 2,4-D amine salt to 12.6 pounds for ammate on apples, from 1.1 pounds for paraquat to 2.1 pounds for simazine on peaches, from 1.2 pounds for paraquat to 11.4 pounds for DNOC on pears, and from 1.4 pounds for simazine to 4.3 pounds for paraquat on tart cherries.

Other Pesticides

Deciduous fruit growers used about 632,000 pounds of other pesticides: plant growth regulators, 299,000 pounds; miticides, 276,000 pounds; and rodenticides, 57,000 pounds (Table 16). About 88 percent (555,500 pounds) of these pesticides was applied to apples. The West was the most important user of these other pesticides accounting for 360,400 pounds (57 percent) of the total.

The primary plant growth regulator used on these fruits was Alar®. It was used primarily on apples to increase flower development, hasten fruit coloring, and maintain fruit firmness. Alar® was also used on peaches and tart cherries to hasten and concentrate ripening. Plictran® was the leading miticide used to control plant-feeding mites.

Deciduous fruit growers were minor users of rodenticides. Of the 57,000 pounds of rodenticides applied, 53,400 pounds (94 percent) were used on apples to control pine and meadow voles primarily in the West.



Table 16. Other (miscellaneous) pesticides: Quantity used on selected deciduous fruits by crop and region, 1978

Crop and other pesticides	:	:	:	:	:	:	:	:	:
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-- Not reported.

1/ Data are from the 1978 Deciduous Fruit Survey, Natural Resource Economics Division, ESS, USDA. Does not include California.

2/ Less than 50 pounds.









